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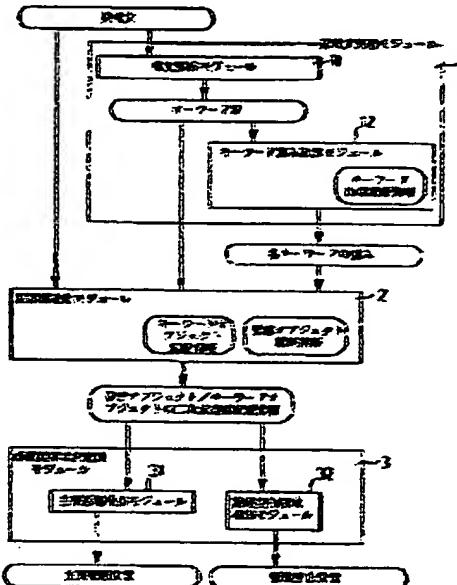
(54) TOPIC PROCESSOR

(57) Abstract:

PROBLEM TO BE SOLVED: To provide a topic processor for making the creativity of a conversation be stronger by activating a participating conversation at all times.

SOLUTION: The speech objects of respective participants are morpheme-analyzed and a key word is extracted by a speech sentence processing module 1 and the relation of the key word and the speech objects is successively arranged on a two-dimensional space and the contents of the conversation is structured by a topic structuring module 2. Then, the developing conditions of a topic are recognized from the contents of the conversation and the transition information of speeches by a topic developing condition recognition module 3, and in response to the detection of topic change by a topic providing module activation module 4, a topic providing module 5 extracts and provides information to be the subject of the topic.

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TOPIC PROCESSING DEVICE

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/1¹

(54) Title of the invention

Topic processing device

(57) Summary

Objective: To provide a topic processing device which is capable of constantly invigorating a conversation among participants and of accordingly rendering the conversation more creative.

Solution mechanism: Key words are extracted as a result of the morphospecies analysis of the statement objects of the respective participants by the statement sentence processing module (1), whereas the contents of a conversation are structured by the sequential configurations of the relatednesses between the key words and statement objects by the topic structuring module (2), whereas the topic unfolding state is grasped, based on the contents of the conversation and on the statement transition information, by the topic unfolding state acknowledgment module (3), whereas, in response to the detection of a topic change by the topic providing module initialization module (4), a set of information which qualifies as a potential topic is extracted and provided by the topic providing module (5).

Patent Claims

/2

¹ Numbers in the margin indicate pagination in the foreign text.

Claim 1

A topic processing device with the following characteristics:

In a topic processing device for invigorating a conversation among multiple conversants, the following are configured:

A key word extraction mechanism which executes the morphospecies analysis of the individual statements of the respective participants as statement objects and which extracts, based on the obtained results, certain types of words alone as key words,

A key word weight calculation mechanism which assesses the weights of the respective key words included in the respective statement objects based on the appearance frequencies and appearance intervals of the respective key words extracted by the aforementioned key word extraction mechanism,

A conversation structuring mechanism which, based on the key words and their weights ascertained by the aforementioned key word extraction mechanism and the aforementioned key word weight calculation mechanism, structures the contents of the conversation by calculating the mutual relatednesses among all the statement objects obtained until a certain temporal stage with reference to relations commonly shared among key word groups included in the respective statement objects, by, on the other hand, calculating the mutual relatednesses among all the key words with reference to co-arising relations among said key words within the respective statement objects, and by expressing, as spatial structures, the

respective mutual relationships among the statement objects and among the key words, and

A major topic detection mechanism which detects, based on the conversation content structure ascertained by the aforementioned conversation structuring mechanism, major topics discussed in the conversation until said temporal stage by seeking the spatial position information within a segment where statement objects are clustered in a peculiarly high density.

Claim 2

A topic processing device with the following characteristics:
In a topic processing device for invigorating a conversation among multiple conversants, the following are configured:

A key word extraction mechanism which executes the morphospecies analysis of the individual statements of the respective participants as statement objects and which extracts, based on the obtained results, certain types of words alone as key words,

A key word weight calculation mechanism which assesses the weights of the respective key words included in the respective statement objects based on the appearance frequencies and appearance intervals of the respective key words extracted by the aforementioned key word extraction mechanism,

A conversation structuring mechanism which, based on the key words and their weights ascertained by the aforementioned key word extraction mechanism and the aforementioned key word weight calculation mechanism, structures the contents of the conversation

by calculating the mutual relatednesses among all the statement objects obtained until a certain temporal stage with reference to relations commonly shared among key word groups included in the respective statement objects, by, on the other hand, calculating the mutual relatednesses among all the key words with reference to co-arising relations among said key words within the respective statement objects, and by expressing, as spatial structures, the respective mutual relationships among the statement objects and among the key words, and

A topic blank region detection mechanism which detects, by calculating the position information on each blank region in which no statement objects exist based on the conversation content structure ascertained by the aforementioned conversation structuring mechanism, topic blank regions arising during the conversation until said temporal stage.

Claim 3

A topic processing device specified in Claim 2 characterized by the additional possession of a major topic detection mechanism which detects, based on the conversation content structure ascertained by the aforementioned conversation structuring mechanism, major topics discussed in the conversation until said temporal stage by seeking the spatial position information within a segment where statement objects are clustered in a peculiarly high density.

Claim 4

A topic processing device specified in Claim 1 or 3 characterized by the additional possession of a major topic-related key word extraction mechanism designed to collect a certain number of key words positioned in the vicinity of the spatial position of the major topic conceptualized by the aforementioned major topic detection mechanism and then to assess the respective weights of these key words in accordance with their distances from the spatial position of said major topic,

An association inspiring mechanism which inspires an association key word group with reference to an association dictionary based on the key word group ascertained by the aforementioned major topic-related key word extraction mechanism, and

A major topic-related information extraction mechanism designed to search, with reference to the association key word group inspired by the aforementioned association inspiring mechanism, a database for related information and then to extract it.

Claim 5

A topic processing device specified in Claim 2 or 3 characterized by the additional possession of a blank region peripheral key word extraction mechanism designed to collect a certain number of key words positioned in the vicinity of the topic blank region conceptualized by the aforementioned topic blank region detection mechanism and then to assess the respective

weights of said key words in accordance with their distances from the topic blank region and

A blank region-related information extraction mechanism designed to search a database for related information with reference to the key word group ascertained by the aforementioned blank region peripheral key word extraction mechanism and then to extract it.

Claim 6

A topic processing device specified in Claim 3 characterized by the additional possession of a blank region peripheral key word extraction mechanism designed to collect a certain number of key words positioned in the vicinity of the topic blank region conceptualized by the aforementioned topic blank region detection mechanism and then to assess the respective weights of said key words in accordance with their distances from the spatial position of the topic blank region,

An association inspiring mechanism which inspires an association key word group with reference to an association dictionary based on the key word group ascertained by the aforementioned major topic-related key word extraction mechanism,

A major topic-related information extraction mechanism designed to search, with reference to the association key word group inspired by the aforementioned association conceptualization mechanism, a database for related information and then to extract it,

A blank region peripheral key word extraction mechanism designed to collect a certain number of key words positioned in the vicinity of the topic blank region conceptualized by the aforementioned topic blank region detection mechanism and then to assess the respective weights of said key words in accordance with their distances from the topic blank region, and

A blank region-related information extraction mechanism designed to search a database for related information with reference to the key word group ascertained by the aforementioned blank region peripheral key word extraction mechanism and then to extract it.

Detailed explanation of the invention

[0001]

(Technical fields to which the invention belongs)

The present invention concerns a topic processing device, and in particular, it concerns a topic processing device which is capable of invigorating a conversation among multiple participants.

[0002]

(Prior art)

Conversations may be regarded as creative acts extremely effective for obtaining novel concepts. The expression "anticipation for an active discussion" as it is often used by

organizers and/or hosts of academic conventions and symposia presumes, for one thing, such an effect of the discussion. It is not uncommon, furthermore, for novel information to be obtained from casual

/3

conversations among researchers gathering in researchers' lounges or for novel concepts or solutions to problems to become hinted.

[0003]

Two major processes are said to be involved in the course of human conceptualization. One pertains to a scattered thinking process, whereas the other to a coherent thinking process. In response to a problem with an uncertain solution, a human first gathers, in the scattered thinking process, large numbers of not only sets of information which are obviously related to said problem but also sets of vaguely related information and intuitively compelling information fragments. The fragmented sets of information thus collected are unified during the coherent thinking process. The human may be said to have arrived at a novel concept if he or she has discovered new relations among the seemingly unrelated information fragments in this context.

[0004]

(Problems to be solved by the invention)

Attempts are made by a handful of conceptualization methods, etc. to deliberately and unambiguously divorce these two processes for the purpose of obtaining concepts more effectively. Brain storming, for example, represents a method intended mainly for

facilitating the scattered thinking process, whereas the KJ method is a technique intended for facilitating the coherent thinking process.

[0005]

These two types, on the other hand, remain mutually indistinguishable in the course of daily conversations. Viewed from a different perspective, however, the daily conversations may be considered to be a blend of said scattered thinking process and coherent thinking process. In other words, various sorts of information become provided by statements made by participants (scattered process). If a given participant then discovers a certain relatedness(es) either between provided information fragments or between a provided information fragment and certain information deduced from his or her own intelligence base (coherent process), said participant presents a new topic based on the discovered relatedness, and the topic becomes unfolded into an unprecedented territory. The conversation progressively continues as a result of the alternate repetition of these scattered and coherent processes.

[0006]

The main objective of the present invention is therefore to provide a topic processing device which is capable of constantly invigorating a conversation among participants and of accordingly rendering the conversation more creative.

[0007]

(Mechanism for solving the problems)

The following is provided by the invention specified in Claim 1: In a topic processing device for invigorating a conversation among multiple conversants, the following are configured:

A key word extraction mechanism which executes the morphospecies analysis of the individual statements of the respective participants as statement objects and which extracts, based on the obtained results, certain types of words alone as key words,

A key word weight calculation mechanism which assesses the weights of the respective key words included in the respective statement objects based on the appearance frequencies and appearance intervals of the respective key words extracted by the aforementioned key word extraction mechanism,

A conversation structuring mechanism which, based on the key words and their weights ascertained by the aforementioned key word extraction mechanism and the aforementioned key word weight calculation mechanism, structures the contents of the conversation by calculating the mutual relatednesses among all the statement objects obtained until a certain temporal stage with reference to relations commonly shared among key word groups included in the respective statement objects, by, on the other hand, calculating the mutual relatednesses among all the key words with reference to co-arising relations among said key words within the respective statement objects, and by expressing, as spatial structures, the

respective mutual relationships among the statement objects and among the key words, and

A major topic detection mechanism which detects, based on the conversation content structure ascertained by the aforementioned conversation structuring mechanism, major topics discussed in the conversation until said temporal stage by seeking the spatial position information within a segment where statement objects are clustered in a peculiarly high density.

[0008]

The following is provided by the invention specified in Claim 2: In a topic processing device for invigorating a conversation among multiple conversants, the following are configured:

A key word extraction mechanism which executes the morphospecies analysis of the individual statements of the respective participants as statement objects and which extracts, based on the obtained results, certain types of words alone as key words,

A key word weight calculation mechanism which assesses the weights of the respective key words included in the respective statement objects based on the appearance frequencies and appearance intervals of the respective key words extracted by the aforementioned key word extraction mechanism,

A conversation structuring mechanism which, based on the key words and their weights ascertained by the aforementioned key word extraction mechanism and the aforementioned key word weight calculation mechanism, structures the contents of the conversation

by calculating the mutual relatednesses among all the statement objects obtained until a certain temporal stage with reference to relations commonly shared among key word groups included in the respective statement objects, by, on the other hand, calculating the mutual relatednesses among all the key words with reference to co-arising relations among said key words within the respective statement objects, and by expressing, as spatial structures, the respective mutual relationships among the statement objects and among the key words, and

A topic blank region detection mechanism which detects, by calculating the position information on each blank region in which no statement objects exist based on the conversation content structure ascertained by the aforementioned conversation structuring mechanism, topic blank regions arising during the conversation until said temporal stage.

[0009]

The invention specified in Claim 3 is characterized, in addition to the constituent elements specified in Claim 2, by the additional possession of a major topic detection mechanism which detects, based on the conversation content structure ascertained by the aforementioned conversation structuring mechanism, major topics discussed in the conversation until said temporal stage by seeking the spatial position information within a segment where statement objects are clustered in a peculiarly high density.

[0010]

The invention specified in Claim 4 is characterized, in addition to the constituent elements specified in Claim 1 or 3, by the additional possession of a major topic-related key word extraction mechanism designed to collect a certain number of key words positioned in the vicinity of the spatial position of the major topic conceptualized by the aforementioned major topic detection mechanism and then to assess the respective weights of these key words in accordance with their distances from the spatial position of said major topic,

An association inspiring mechanism which inspires an association key word group with reference to an association dictionary based on the key word group ascertained by the aforementioned major topic-related key word extraction mechanism, and

A major topic-related information extraction mechanism designed to search, with reference to the association key word group inspired by the aforementioned association inspiring mechanism, a database for related information and then to extract it.

[0011]

The invention specified in Claim 5 is characterized, in addition to the constituent elements specified in Claim 2 or 3, by the additional possession of a blank region peripheral key word extraction mechanism designed to collect a certain number of key words positioned in the vicinity of the topic blank region conceptualized by the aforementioned topic blank region detection

mechanism and then to assess the respective weights of said key words in accordance with their distances from the topic blank region and

A blank region-related information extraction mechanism designed to search a database for related information with reference to the key word group ascertained by the aforementioned blank region peripheral key word extraction mechanism and then to extract it.

[0012]

The invention specified in Claim 6 is characterized, in addition to the constituent elements specified in Claim 3, by the additional possession of a blank region peripheral key word extraction mechanism designed to collect a certain number of key words positioned in the vicinity of the topic blank region conceptualized by the aforementioned topic blank region detection mechanism and then to assess the respective weights of said key words in accordance with their distances from the spatial position of the topic blank region,

An association inspiring mechanism which inspires an association key word group with reference to an association dictionary based on the key word group ascertained by the aforementioned major topic-related key word extraction mechanism,

A major topic-related information extraction mechanism designed to search, with reference to the association key word group inspired by the aforementioned association inspiring

mechanism, a database for related information and then to extract it,

A blank region peripheral key word extraction mechanism designed to collect a certain number of key words positioned in the vicinity of the topic blank region conceptualized by the aforementioned topic blank region detection mechanism and then to assess the respective weights of said key words in accordance with their distances from the topic blank region, and

A blank region-related information extraction mechanism designed to search a database
for related information with reference to the key word group ascertained by the aforementioned blank region peripheral key word extraction mechanism and then to extract it.

[0013]

(Application embodiments of the invention)

Figure 1 is a block diagram which shows an application embodiment of the present invention. In Figure 1, a statement sentence becomes inputted as text data, and each of the individual texts inputted sequentially is referred to as a "statement object." This statement object is fed into the statement sentence processing module (1) and the topic structuring module (2). The statement sentence processing module (1) is constituted to include the sentence structure analysis module (11) and the key word weight calculation module (12), whereas the sentence structure analysis module (11) extracts a key word group based on the

morphospecies analysis of the inputted statement objects. This key word group is inputted not only into the topic structuring module (2) but also into the key word weight calculation module (12). The key word weight calculation module (12) calculates the weights of the respective key words and then feeds the obtained results into the topic structuring module (2).

[0014]

The topic structuring module (2) structures the contents of the conversation by configuring, on a two-dimensional space, the relatedness(es) between the key word objects and statement objects obtained until the current stage. The two-dimensional statement object/key word object configurational information becomes fed into the topic unfolding state acknowledgment module (3). The topic unfolding state acknowledgment module (3) includes the major topic detection module (31) and the topic blank region detection module (32), and the major topic detection module (31) detects the position of a major topic(s), whereas the topic blank region detection module (32) detects a topic blank position(s).

[0015]

Figure 2 is a flow chart provided for explaining the respective actions of the topic structuring module (2) and topic unfolding state acknowledgment module (3) shown in Figure 1.

[0016]

Next, concrete actions of [this] application embodiment of the present invention will be explained with reference to Figures 1 and 2. The sentence structure analysis module (11) of the

statement sentence processing module (1) analyzes the sentence structures of the inputted statement objects and then determines the parts of speech of the respective words. Next, nouns and words whose parts of speech were undeterminable alone are isolated, and this class of words is designated as the key words of the corresponding statement objects. The key word weight calculation module (12) then calculates the weight w_{win} of the key word w_i of the n-th statement object by using the following formula:

[0017]

$$w_{wi,n} = \frac{\left(1 + \frac{1}{1 + e^{-f_{wi} + R}}\right) \left(1 + \frac{1}{1 + e^{-i_{wi} + I}}\right)}{\left(1 + \frac{1}{1 + e^{-f_{wi} + F_g}}\right)^2}$$

[Numerical 1]:

[0018]

In the above, " f_{wi} " signifies the number of statement objects in which w_i has appeared until the n-1st statement object, whereas " f_{win} " signifies the appearance frequency of w_i in the n-th statement object, whereas " i_{win} " signifies the identity of the statement object in which w_i appeared most recently prior to the n-th statement object. Moreover, F_g , F_I , and I are each constants, and values of 5, 1, and 10 are respectively assigned from an empirical standpoint.

[0019]

Such a weighting scheme is orchestrated for the following reasons. First, key words of high appearance frequencies are

either words which are generally used for nearly all conversations or words which are related to the overall topic of the conversation, and in either case, the level of significance is low in the context of structuring the topic. If these words become heavily weighted, the respective topic clusters may become ambiguous at the topic structuring stage, which will be discussed on a later occasion.

[0020]

[The foregoing scheme is] predicated on the assumptions that a word which frequently appears within a single statement bears a high level of significance in relation to said statement and that the level of significance of even a high-frequency word becomes high in a case where it is used after a certain period of non-use.

[0021]

Next, the topic structuring module (2) calculates, at the step (abbreviated as "SP" in the graphic illustration) SP1 shown in Figure 2, the distances among the respective objects based on the dual scaling method by using the relations shared commonly by the key word objects of the respective statement objects, which are tantamount conversely to the co-arising relationships of the respective key word objects within the statement objects. The dual scaling method hereby signifies a technique wherein, in a case where an object aggregate constituted by multiple numerically parameterized attributes is given, attributes commonly shared among the objects and co-arising tendencies among the attributes themselves are expressed as relative positional relations by

assigning numerical ranked magnitudes respectively to the object aggregate and attribute aggregate. At the step SP2, two uppermost major components that quantify the spatial structure in the order of contribution are isolated, and the position information sets of the respective objects on the two-dimensional space are determined.

[0022]

The major topic detection module (31) of the topic unfolding state acknowledgment module (3) divides, at the step SP3, the two-dimensional space, into 16×16 cells. At the step SP4, furthermore, the average number of statement objects included in each of the n-th cell and eight cells around said cell is calculated and designated as the weight of the n-th cell. The same is calculated for all the 16×16 cells. Cells the weights of which exceed the specified threshold value θ are selected at the step SP5 and designated as major topic cells, and subsequently, the respective center coordinates of these cells are outputted.

[0023]

The topic blank region detection module (32), on the other hand, calculates, at the step SP6, not only the center position of a region(s) in which a zero-weight cell(s) exists but also the weight of its center (distance from a non-zero-weight region, and the weight becomes heavier as the distance becomes longer) based on the application of the Euclidean distance conversion method, etc. The Euclidean distance conversion method signifies a

technique for calculating, on a space, the distances not only from the center of a region but also from peripheral positions around said center. As a result, blank region centers which exceed the specified weight threshold value ϕ become selected and designated as topic blank centers, and the coordinates of the centers of these regions become outputted.

/5

[0024]

As has been mentioned earlier, the major topic positions and topic blank positions can be detected in this application embodiment.

[0025]

Figure 3 is a block diagram which shows another application embodiment of the present invention. In Figure 3, the statement sentence processing module (1), the topic structuring module (2), and the topic unfolding state acknowledgment module (3) are similar to their respective counterparts in Figure 1, whereas the topic providing module initialization module (topic change detection module) (4) and the topic providing module (5) are additionally configured in this application embodiment of the present invention. The topic providing module initialization module (4) detects a topic change point(s), whereas the topic providing module (5) provides a user, at the timing commanded by the topic providing module initialization module (4), with sets of information extracted as potential topics depending on the prevailing circumstances. For this reason, the topic providing

module (5) includes the key word extraction and weight calculation module (51), the article database search module (52), and the association inspiring module (53).

[0026]

Figure 4 is a flow chart provided for explaining the action of the topic providing module (5) shown in Figure 3. Incidentally, actions similar to their counterparts of Figure 1 are invoked respectively from the statement sentence processing module (1), the topic structuring module (2), and the topic unfolding state acknowledgment module (3) shown in Figure 3, and major topic positions and topic blank positions are detected and fed into the topic providing module (5). The topic providing module (5) judges, at the step SP11, whether or not an initialization command has arrived from the topic providing module initialization module (4), and it stands by in a case where no initialization command has arrived, whereas, in a case where an initialization command has arrived, it judges, at the step SP12, whether or not a topic blank position(s) has been detected by the topic unfolding state acknowledgment module (3).

[0027]

In a case where a topic blank region(s) exists, the topic blank region center closest to the most recently inputted statement object is sought at the step SP13, whereas a specified number, namely m , of key word objects closest to the topic blank region center are collected in proper order by the key word extraction and weight calculation module (51) at the step SP14.

At the same time, a weight inversely related to the distance from the topic blank region center is calculated for each key word object. At the step SP15, furthermore, the acquired weighted key word group is designated as a search key word group. At the step SP16, the article database possessed by the article database search module (52) is searched with reference to said search key word group, and the search results are then provided.

[0028]

In a case where no topic blank region is judged to exist at the step SP12 discussed earlier, the major topic cell closest to the most recently inputted statement object is sought at the step SP17. The key word extraction and weight calculation module (51) then collects, at the step SP18, a specified number, namely m, of key word objects closest to the major topic cell center in proper order. At the same time, the weights of the respective key word objects inversely related to the distances from the major topic cell center are calculated. The association inspiring module (53) inspires association, at the step SP19, based on an association phenomenon [sic: Presumably "dictionary"] orchestrated preliminarily on the system by using the weighted key word group thus calculated, as a result of which an association key word group becomes obtained. Next, the article database of the article database search module (52) is searched by using the acquired association key word group as a search key word group at the step SP20 and by using the search key word group at the step SP16 [sic], and the search results are then provided.

[0029]

As has been mentioned above, as far as the present invention is concerned, the statements of the respective participants are individually subjected, as statement objects, to morphospecies analyses, whereas certain types of words alone are extracted, as key words, from the obtained results, whereas the weights of the respective key words included in the individual statement objects are assessed based on the appearance frequencies and appearance intervals of the respective key words thus extracted, whereas the mutual relatednesses among all the statement objects obtained until a certain temporal stage are calculated with reference to relations commonly shared among the key word groups included in the respective statement objects, whereas the mutual relatednesses among all the key words, on the other hand, are calculated with reference to co-arising relations among said key words within the respective statement objects, whereas the respective mutual relationships among the statement objects and among the key words are expressed as spatial structures for the purpose of structuring the contents of the conversation, whereas major topics discussed in the conversation until said temporal stage are detected, based on the conversation content structure ascertained by the aforementioned conversation structuring mechanism, by seeking the spatial position information within a segment where statement objects are clustered in a peculiarly high density, based on which it becomes possible not only to execute a routine for acquiring topics for all types of conversations but also to discover new

topic unfolding directions by detecting blank region(s). Topics can, furthermore, be acquired not only from purposefully conceptualized conversations but also from freely unfolding conversations, due to which it is unnecessary to designate newly unfolding directions of topics as preliminary plans, and it becomes possible to acquire new unfolding directions directly from the prevailing circumstances depending on the states of conversations.

Brief explanation of the figures

Figure 1: An approximate block diagram pertaining to an application embodiment of the present invention.

Figure 2: A flow chart provided for explaining the respective actions of the topic structuring module and topic unfolding state acknowledgment module shown in Figure 1.

Figure 3: A block diagram which shows another application embodiment of the present invention.

Figure 4: A flow chart provided for explaining the action of the topic providing module shown in Figure 3.

(Explanation of notations)

- (1): Statement sentence processing module;
- (2): Topic structuring module;
- (3): Topic unfolding state acknowledgment module;
- (4): Topic providing module initialization module;
- (5): Topic providing module;

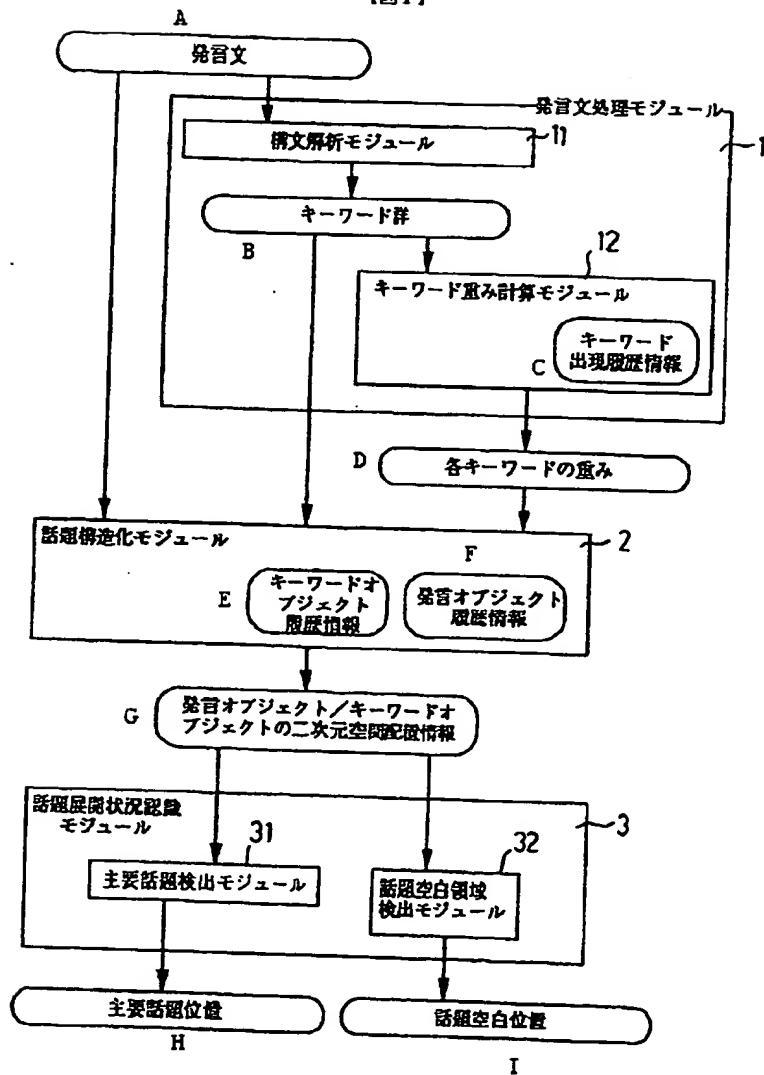
(11): Sentence structure analysis module;
(12): Key word weight calculation module;
(31): Major topic detection module;
(32): Topic blank region detection module;
(51): Key word extraction and weight calculation module;

/6

(52): Article database search module;
(53): Association inspiring module.

Figure 1

[図1]

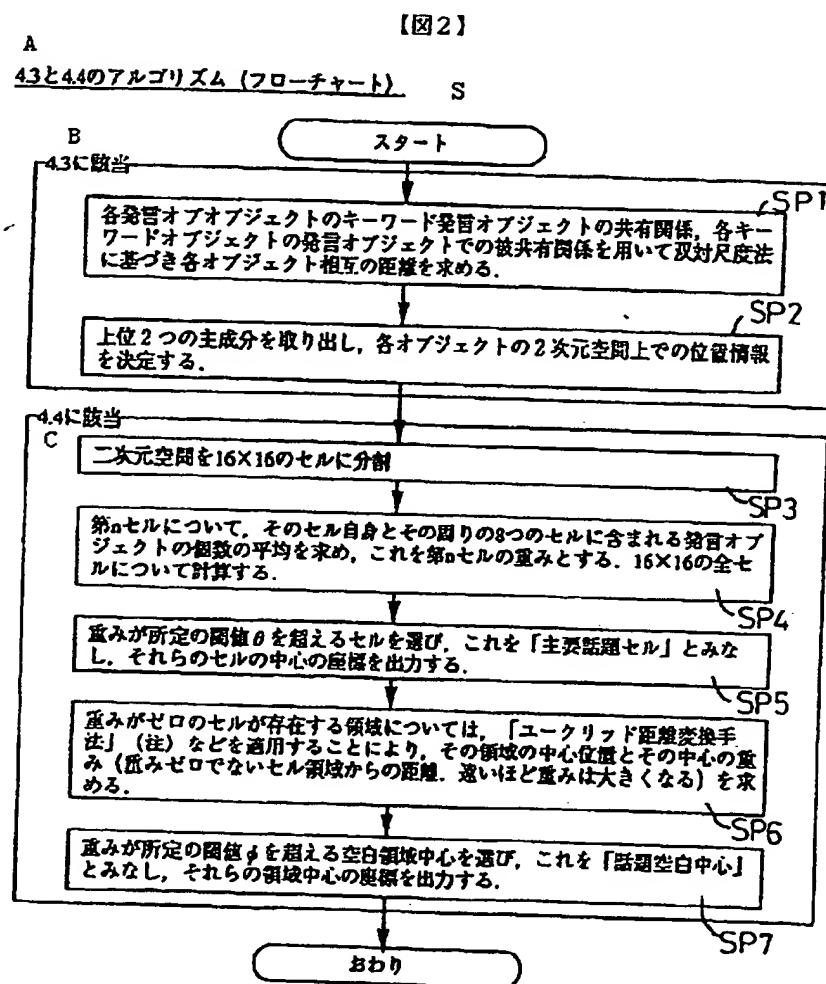


(A): Statement sentence; (A): Key word group; (C): Key word appearance history information; (D): Weights of the respective key words; (E): Key word object history information; (F): Statement object history information; (G): Two-dimensional spatial configurational information on the statement object/key word object; (H): Major topic position; (I): Topic blank position; (1):

Statement sentence processing module; (2): Topic structuring module; (3): Topic unfolding state acknowledgment module; (11): Sentence structure analysis module; (12): Key word weight calculation module; (31): Major topic detection module; (32): Topic blank region detection module]

Figure 2

/7



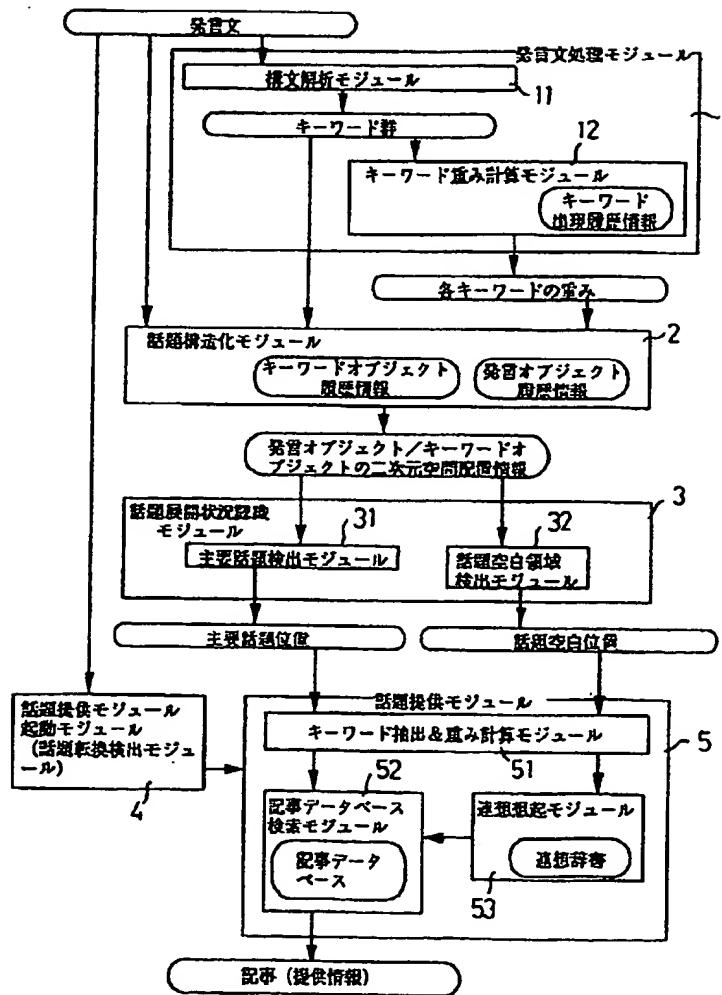
[(A): Algorithms for 4.3 and 4.4; (B): Corresponding to 4.3; (C): Corresponding to 4.4; (S): Start; (E): End; (SP1): The distances among the respective objects are calculated based on the dual scaling method by using the relations shared commonly by the key word statement objects of the respective statement objects and the relations shared commonly by the key word objects of the respective statement objects; (SP2): Two uppermost major components are isolated, and sets of position information on the respective objects on a two-dimensional space are determined; (SP3): The two-dimensional space is divided into 16 x 16 cells; (SP4): The average number of statement objects included in each of the n-th cell and eight cells around said cell is calculated and designated as the weight of the n-th cell; the same is calculated for all the 16 x 16 cells; (SP5): Cells the weights of which exceed the specified threshold value θ are selected and designated as "major topic cells," and subsequently, the respective center coordinates of these cells are outputted; (SP6): Not only the center position of a region(s) in which zero-weight cells exist but also the weight of its center (distance from a non-zero-weight region, and the weight becomes heavier as the distance becomes longer) based on the application of the "Euclidean distance conversion method" (see Note [sic: None provided]), etc.; (SP7):

Blank region centers which exceed the specified weight threshold value ϕ become selected and designated as "topic blank centers", and the coordinates of the centers of these regions become outputted]

Figure 3

/8

【図3】

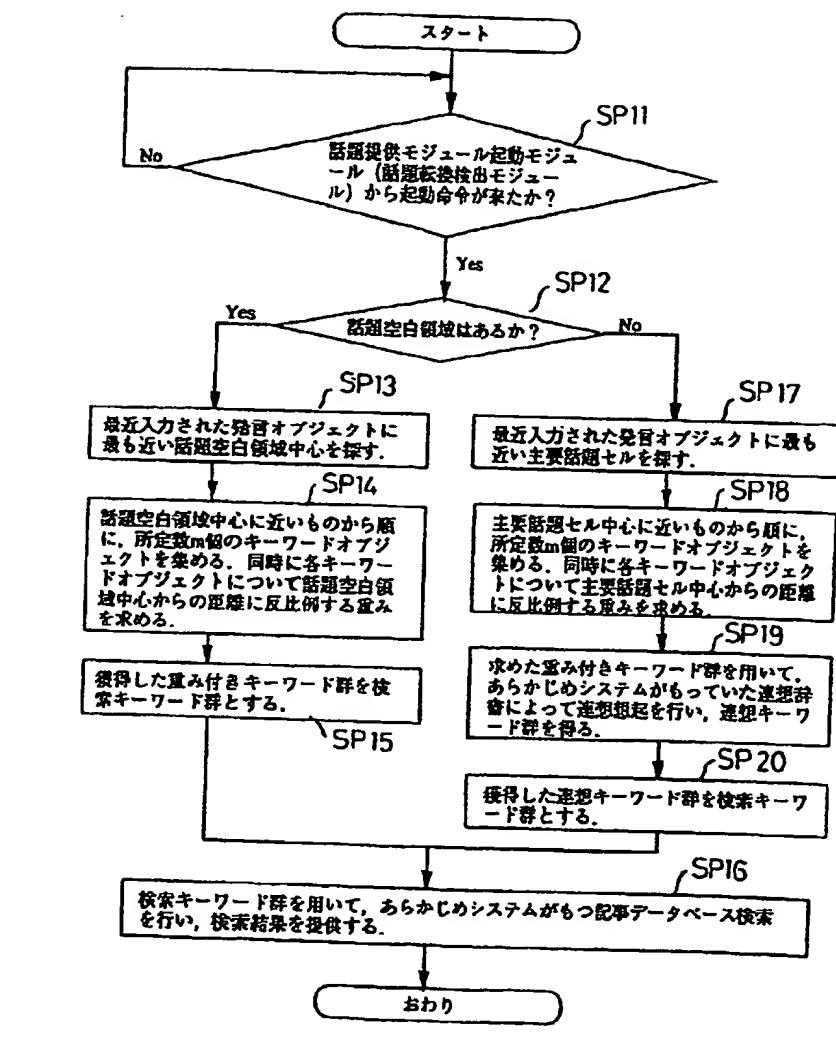


[(A): Statement sentence; (A): Key word group; (C): Key word appearance history information; (D): Weights of the respective key words; (E): Key word object history information; (F): Statement object history information; (G): Two-dimensional spatial configurational information on the statement object/key word object; (H): Major topic position; (I): Topic blank position; (J): Article database; (K): Association dictionary; (L): Article (provided information); (1): Statement sentence processing module; (2): Topic structuring module; (3): Topic unfolding state acknowledgment module; (4): Topic providing module initialization module (topic change detection module); (5): Topic providing module; (11): Sentence structure analysis module; (12): Key word weight calculation module; (31): Major topic detection module; (32): Topic blank region detection module; (51): Key word extraction & weight calculation module; (52): Article database search module; (53): Association inspiring module]

Figure 4

/9

【図4】



((S): Start; (E): End; (SP11): Has an initialization command arrived from the topic providing module initialization module (topic change detection module)?; (S12): Does a topic blank region(s) exist?; (SP13): The topic blank region center closest to

the most recently inputted statement object is sought; (SP14): A specified number, namely m , of key word objects closest to the topic blank region center are collected in proper order; at the same time, a weight inversely related to the distance from the topic blank region center is calculated for each key word object; (SP15): The acquired weighted key word group is designated as a search key word group; (SP16): The article database orchestrated preliminarily on the system is searched with reference to said search key word group, and the search results are then provided; (SP17): The major topic cell closest to the most recently inputted statement object is sought; (SP18): A specified number, namely m , of key word objects closest to the major topic cell center in proper order are collected; at the same time, the weights of the respective key word objects inversely related to the distances from the major topic cell center are calculated; (SP19): Association is inspired based on an association dictionary orchestrated preliminarily on the system by using the weighted key word group thus calculated, as a result of which an association key word group becomes obtained; (SP20): The acquired association key word group is designated as a search key word group]